Program Development

HURRICANE PROTECTION PROJECT

NEW LONDON

HURRICANE PROTECTION

NEW LONDON, CONNECTICUT

SUPPLEMENTAL REPORT TO THE AUTHORIZED PROJECT

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

JUNE 1976

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED-E

17 June 1976

SUBJECT: New London Hurricane Protection Project, Supplemental Report to the Authorized Project.

HQDA(DAEN-CWP)
WASH DC 20314

1. Submitted for your review is a Supplemental Report to the Authorized Project for the New London Hurricane Protection Project, New London, Connecticut.

2. This Report describes the events that initiated re-evaluation undertaken in the reformulation of the project and is in 3 parts:

Part I - covers the Engineering, Design, Cost and Construction features of the proposed hurricane protection project.

Appendix A - Alternative Study to regrade the renewal area to the elevation of a 100-year storm frequency.

Part II - describes the Impact Assessment.

Part III - covers the coordination and views of the Federal, State and local agencies.

3. The benefit-cost ratio of the proposed project is 1.4 to 1. No benefit analysis is shown for the regrading alternative other than to indicate that the cost of the alternative is comparable to the cost of the proposed project.

4. It is recommended that this Supplemental Report form the basis for providing hurricane flood protection for the city of New London Urban Renewal Area consistent with the requirements of the Federal Housing and Urban Development Agency and the City Redevelopment Agency.

Incl (8 cys)
as

JOHN H. MASON
Colonel, Corps of Engineers
Division Engineer

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

NEW LONDON HURRICANE PROTECTION PROJECT

NEW LONDON, CONNECTICUT

SUPPLEMENTAL REPORT

to the

AUTHORIZED PROJECT

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASSACHUSETTS

June 1976

PART I

ENGINEERING DESIGN, COST & CONSTRUCTION FEATURES

NEW LONDON HURRICANE PROTECTION PROJECT

NEW LONDON, CONNECTICUT

DESIGN MEMORANDA INDEX

No.	Title	Anticipated Submission Date	Date Submitted	Date Approved
1.	Hurricane Tidal Hydraulics		15 Oct 65	14 Jan 66
2.	General Design (Incl Site Geology)		12 Jan 66	15 Mar 66
2.	General Design (Revised)	Dec 76		
3.	Concrete Materials		2 Nov 65	16 Dec 65
4.	Real Estate		2 Mar 70	1 May 70
5.	Bentleys Creek Barrier		10 Apr 70	1 Jun 70
6.	Embankments and Foundations, Structures and Cathodic Protection	Mar 77		

SUPPLEMENTAL REPORT TO
AUTHORIZED PROJECT

NEW LONDON HURRICANE PROTECTION PROJECT

NEW LONDON, CONNECTICUT

A. PERTINENT DATA

1. Purpose	Hurricane Tidal Protection
2. Location of Project	
State	Connecticut
County	New London
City	New London
3. Drainage Areas	
Shaw Cove	755 Acres
4. Embankments	
Type	Earth Fill with Rock Toes and Facing
Elevation, Top of Embankment	14.5 m.s.l. & El. 12.0
Length	3000 ft.
Maximum Height	10.0 feet to 11.5 feet
Side Slopes	1 on 2
Top Width	Varies
5. Walls	
1. Reinforced Concrete L-Wall	
Top Elevation	+14.5 m.s.l.
Base Elevation	+ 3.5 m.s.l.
Length	525 feet
2. I-Wall	
Top Elevation	+14.5 m.s.l.
Length	96 feet

6. Pumping Stations

Structure	Reinforced Concrete Superstructure with Brick Facade
Pumps (3)	Vertical Axial Flow
Power Units	Diesel Engine
Pumping Capacity	210 c.f.s.

7. Principal Quantities

Embankment	
Excavation, Land Areas	34,000 c.y.
Impervious Fills	24,000 c.y.
Dumped Rock Fill	18,000 c.y.
Bedding Stone Protection	7,300 c.y.
Armor Stone	4,300 c.y.
Concrete, Reinforced	1,070 c.y.
Walls, Z-Piling	10,250 s.f.
Circular Cells, Sheet Pile	18,000 s.f.
Granular Cell Fill	2,750 c.y.
Dredging	13,000 c.y.

8. Estimated Project Cost

Lands and Damages		$ 850,000
Construction		
Levees & Floodwalls	$2,595,000	
Pumping Station	1,290,000	
Pressure Conduit	1,870,000	
		5,505,000.
Engineering & Design		545,000
Supervision & Administration		470,000
Total Project Cost		$ 7,620,000
Federal Contribution		5,340,000
Local Contribution 30%		2,280,000

ECONOMIC ANALYSIS

Annual Benefits	$ 704,000
Annual Costs	$ 506,000
Benefit to Cost Ratio	1.4 to 1
CONSTRUCTION PERIOD	2 years

SUPPLEMENTAL REPORT TO AUTHORIZED PROJECT

HURRICANE FLOOD PROTECTION PROJECT

NEW LONDON, CONNECTICUT

June 1976

PURPOSE

The purpose of this report is to outline events leading up to the proposed revision in scope and degree of protection for the subject project, and to present the project revision for approval in order to proceed with design of the revised project.

BACKGROUND

The original hurricane flood protection plan for New London was authorized by the Flood Control Act of 1962. Design of the project started in 1965 with initial construction funds authorized in FY-67. Delays were encountered from 1966 through 1968 in the completion of project design. These delays were at the request of the City to permit the development of plans for urban renewal and master highway plan.

The authorized project consisted of two separate barriers at Shaw Cove and Bentleys Creek with gated navigation openings, street gate, pumping station and railroad gate. Estimated cost for Bentleys Creek was $4.7 million and $9.2 million for Shaw Cove. Assurances of local cooperation for the complete project were accepted from the City in February 1970. Separate construction contracts were scheduled for Bentleys Creek and Shaw Cove. Required local funds were received in November 1970 prior to issuing for bids the Bentleys Creek portion of the project. Prior to advertising, the City requested a deferment on construction due to strong public sentiment against local expenditures for the project. The New London City Council requested the Division office modify the project by deleting Bentleys Creek and relocating Shaw Cove dike. In addition to this relocation, the City requested that the degree of flood protection be reduced to a 100-year storm frequency which is a minimum HUD requirement for urban renewal areas.

The City engaged a consultant to study flood protection alternatives to the authorized hurricane barrier. An urban renewal project in the Shaw Cove area is dependent on the hurricane storm flood protection. The plan local interests now desire is one that will afford flood protection only for the Shaw Cove urban renewal area, in order to receive funding from HUD. During this study period, the City and the State of Connecticut requested the return of contributed non-Federal funds, until the project is reformulated.

A project status report letter from the Division Engineer was used by the City Redevelopment Agency as an exhibit in a request to HUD for a loan and grant in the amount of approximately $31 million towards their Shaw Cove renewal project. A local referendum in April 1973 approved a bond issue as the City's share of the renewal project. The City agency is now in the process of real estate acquisition for their renewal program.

PROJECT LOCATION

Location. The project is located in New London County, State of Connecticut, on the west side of the Thames River estuary approximately 45 miles southeast of Hartford, Connecticut and 50 miles southwest of Providence, Rhode Island. The project will start at the intersection of Shaw and Hamilton Streets along the west side of the cove and terminate at high ground at Bank Street approximately 300 feet north of Spayard Street. Plate 2-1 shows the relative location of the project area.

ALTERNATE STUDIES

Alternate proposals were studies for providing 100-year storm protection (still water level EL. 10 MSL vs. EL. 14 MSL for the standard project hurricane) for the Shaw Cove urban renewal area. This reduction in the level of protection was accepted based on the fact that HQDA had advised that precedence for using 100-year storm frequency had been accepted for other projects on the Louisiana coast and Wrightsville S.C. The various proposals studied were as follows:

a. A dike located approximately 200 yards west of the authorized Shaw Cove Dike, which would require a navigation gate opening and 2 street gates to prevent back-door flooding from the deleted Bentleys Creek Dike. A 400-cfs pump station would also be required as in the authorized project.

b. A system of dikes and I-walls around the north, west and south shores of Shaw Cove with 2 street gates as required in a. above. A 1200-cfs pump station would be required since the cove is lost as a ponding storage area. Proposals in a. and b. would protect areas larger than that planned for urban renewal.

c. Regrade the immediate renewal area above the 100-year storm level, provide extensive utility modifications and a 900-cfs pump station.

d. Fill in Shaw Cove to an elevation of the 100-year storm (EL. 10 MSL) and provide a 1200-cfs pump station.

e. Dike and I-wall system around the north and west shores of the cove with a street gate and 900-cfs pump station. This proposal protects the immediate renewal area only.

ORIGINAL PROTECTION PLAN

The original protection plan for the city of New London was formulated in 1965 and presented in General Design Memorandum No. 2, dated 12 January 1966. The scope of the project was considerably greater in that the plan provided protection for both the Shaw Cove and Bentleys Creek segments of the city. The Shaw Cove segment consisted fo a rock faced earth dike approximately 1,900 feet long, running across the mouth of Shaw Cove extending from the Atlantic Oil Company property (north of Smith Street) on the south and terminating on the north at Bank Street. Within the dike a 45 foot navigation opening was provided to permit boats to pass through the barrier. Prior to advertising, the city requested a deferment on construction due to strong public sentiment against local expenditures for the project. The New London City Council requested the Division office to modify the project by deleting the Bentleys Creek and relocating the Shaw Cove dike. In addition to this relocation, the city requested that the degree of flood protection be reduced to a 100-year storm frequency which is a minimum requirement for urban renewal areas.

PROPOSED PLAN

The selected plan (Plate 1) is the end product of economic, local interest and environmental considerations. Little flexibility existed in the alignment selection due to constrictions of shore line, the main line railroad tracts, existing structures and the urban renewal development plans. Only limited areas of the project permitted any variation in the project alignment. In the vicinity of the City Coal Company an extensive investigation was made as to the structure and alignment most suitable to provide the necessary protection. Several variation of structures and alignment were studied. Two of the alignments excluded the tank farm from the area being protected whereas four alignments provided protection for the oil tanks. The plan selected was considered to be the most desirable since it minimized potential damage to the oil tanks, and was determined to be more aesthetically pleasing. The selected plan was the most acceptable to the city.

DESCRIPTION OF STRUCTURES AND IMPROVEMENTS

Description. The protection plan consists primarily of a dike section running from high ground at Hamilton Street on the south end and terminating at high ground at Bank Street on the north end. In general the aligment follows the shore line rather closely and is modified as necessary to be (1) compatible with the urban renewal plans, (2) to avoid costly real estate and (3) to provide access to real estate outside the protective works. The top elevation of the barrier from the south end (Sta 0+00) to the Pumping Station (Sta 18+90) shall be at El. 12.00 msl and from the Pumping Station to the north end shall be at El. 14.5 msl.

Earth Dikes. The dikes will consist of an impervious core, a gravel bedding on the cove side, filter cloth, and stone protection on the cove side, land side as well as on the top of the dike ~~(See~~ The dike section from Sta 9+00 to 18+00 will consist of the basic dike section plus a level area approximately 80 feet wide on the cove side of the dike . The rock necessary to build the low level rock dike is expected to be obtained from the installation of the pressure conduit. The pressure conduit is to be constructed by the city prior to construction of the barrier with approval from the Chief of Engineers.

Circular Steel Cell & "L" Wall. A comparative study indicated that the combination of a 20-foot diameter circular sheet steel cell with a reinforced concrete "L" wall was the most practical means of providing protections between the two dikes (Sta 19+30 to 22+00). The structures were located as far away from the oil tanks to minimize the possibility of damage to the tanks. Locating the cells outside the limit of the existing bulkhead line will eliminate the need for excavating old foundations and driving sheeting through man made fills. The stability inherent with circular cells results in a minimum amount of pile driving for penetration. The concrete cap over the cells at El. 5.0 will serve as the base of the "L" wall as well as serve as the replacement for the existing fueling dock.

Ramp and "L" Wall. To provide access to properties on the Cove side of the barrier, a ramp has been provided Once over the barrier, traffic may proceed along the Access Road running parallel to the railroad and will cross the railroad at locations designated and provided for by the city. A guard rail system will be provided along the railroad to contain traffic. To minimize the interference of the project on the Urban Renewal Project, a "L" wall was utilized at the request of the city.

Pressure Conduit. The pressure conduit will intercept flows from Truman Brook in the vicinity of Grand Street. By means of a 96 inch diameter concrete conduit, flows will be directed from Grand Street southerly along Jefferson Ave., easterly parallel along Bank Street under urban

renewal property, and then southerly passing the pumping station on the westerly side and discharging into the cove. An emergency closure gate is proposed for the conduit on the discharge end.

I-Walls. Cantilevered I-walls are provided to tie in concrete walls into the earth dikes. Sheet pile cutoff will be used with the cantilever wall.

Pumping Station.

a. General. The pumping station will be situated behind the barrier at Sta 18+90 The station will consist of reinforced concrete, steel frame and brick facade. The station will be fed by a 72 inch storm drain which during normal conditions water will pass thru the station and under the dike by gravity to the cove. During flooding conditions, appropriate gates will be closed and storm flows will be directed to the station where it will be pumped over the barrier. Installed pumping capacity will be 210 cfs.

b. Equipment. The pumping station will utilize three vertical axial flow pumps driven by diesel engines through right angle gear units. Each pump will have a capacity of 70 cfs (31,420 gpm). The pumps will be suspended in a normally dry sump with motor-operated sluice gates at the entrance. Pumps will discharge in individual lines running over the top of the dike. Past records indicate the local electric power supply is not adequately reliable for reliance on electric motor drives. Because of the lack of ponding area, frequent cycling of the pumps would be necessary during periods of low flow. To alleviate this unsatisfactory condition a valved by-pass will be provided in the discharge from each pump. Valves will be motor operated. Normal runoff will be conducted to the ocean by gravity through a 72 inch diameter reinforced concrete pipe. The gravity discharge pipe will be provided with a motor-operated sluice gate on the riverside of the dike and a flap gate on the discharge end of the pipe. The station will be provided with sump pump, heating equipment and hand-operated crane for installation and maintenance of equipment. A small diesel electric generating unit will be provided for station auxiliaries and lighting in event of failure of public utility service.

c. Electric Service. The Hartford Electric Light Company will extend 13,200 volt overhead primary service approximately 250 feet to the pumping station. The utility will provide transformers to transform 13,200 volts to 208/120 volts, 3 phase, 4-wire, 60 hertz secondary. Underground service will be provided from pumping station to the transformer pole.

d. Telephone Service. The Southern New England Telephone Company will extend a cable from Bank Street to the pumping station in an underground conduit.

CONSTRUCTION PROCEDURES AND DIVERSION PLAN

Dikes. Construction of the dikes are expected to present no particular problems. Unsuitable material will be removed as necessary and replaced with suitable impervious fill. Placement of the impervious material is expected to be done in the dry. All dikes, except between Sta 22+00 and 25+80 are sufficiently landward of the shore such that no extensive cofferdam system is required. For the segment of dike extending into the Cove the construction procedure encompasses the removal of unsuitable material, replacing it with dumped sand fill, constructing a dumped rock fill section to El. 2.0 and filling behind the dumped rock fill with gravel. Construction above the gravel fill will be in the dry and will present little problems.

Circular Steel Cell & "L" Wall. Unsuitable material will be removed as necessary prior to the installation of the cells. The cells will then be constructed as shown on Plate # by means of a floating plant. As each cell is driven it will be filled with clean granular material. The area immediately behind the cells is to be filled with clean waste material and graded to suit the existing terrain. The "L" wall would then be formed and constructed on top of the cells.

Pumping Station and "L" Wall at Access Road. Neither structure is expected to present any serious construction problems. Both structures are sufficiently removed from the waters edge such that cofferdams are not needed. Sufficient room exists around the structures to provide the Contractor with freedom of movement. At both locations, unsuitable man made fill must be removed prior to constructing the structures. Ground water is expected to be controlled by pumps or by a well point system such that all work will be performed in the dry.

Pressure Conduit. Except for the depth of excavation and certain restricted areas, the construction of the pressure conduit should be routine. It is expected that the construction of the conduit will be initiated at the Cove end and then proceed uphill to Truman Brook. A small cofferdam will be required at the cove end to permit construction of the outlet structure. Once the outlet structure is completed the

installation can proceed inland with little interference from ground water. It is logical to assume that the Contractor will commence at the lowest elevation (Shaw Cove) and proceed upward to Truman Brook. By proceeding in this direction, the drainage is away from the working face; ground water is readily controlled and the risk of flooding equipment is reduced. Excavated earth faces will be adequately braced by structural means in order to protect the workmen as well as protect adjacent buildings.

ACCESS ROADS

General. The project will be located in a highly urbanized area. All streets leading to the site are congested with local city traffic. Construction vehicles travelling to the site will use the area presently being cleared by the Redevelopment Agency. This congestion by the Contractor will be minimal.

CORROSION MITIGATION

Corrosion Mitigation. There are two areas where steel sheathing is used:

a. Circular steel cells which support the "L" wall from Station 19+30 to 22+00. The unsuitable materials within the cell area will be removed before driving the sheathing. The interior of the cells will be filled with clean gravel. Random fill shall be used as backfill on the landward side. The seaward portion will be exposed to salt water of Shaw Cove. "I" walls using steel sheathing will connect the steel cells to the dikes. All of this piling will be painted with a system 6 - A-Z as defined by Guide Specification CE 1409. In addition, the steel will be protected by a cathodic protection system using sacrificial anodes.

b. Steel sheathing serves as a cutoff for the "L" wall from Station 29+70 to 32+33. "I" walls using steel sheathing will connect the "L" walls to the dikes. The steel sheathing will be painted with a system 6 - A-Z.

Tests have not been made on soil samples because the fill materials are considered to be nonuniform. Water resistivity and PH readings will be taken during the preparation of the Cathodic Protection Design Memo.

ENVIRONMENTAL ANALYSES

Environmental Quality Aspects of Architectural Design. Architectural design of structures and facilities required for this project will be based upon fulfillment of functional needs and consideration of the

adjacent environment within an urban renewal area. Design development will provide an aesthetic value best suited to preserving, maintaining, or enhancing the urban quality at the locale of the feature described. Landscaping and other visual amenities, which provide additional aesthetic enhancement to the project will be incorporated during the final design.

The principal structure requiring a studied application of aesthetic criteria is the pumping station. Exterior walls will be composite face brick and concrete masonry units with a minimum of fenestration. Facade and roof detailing will be developed to be compatible with adjacent construction through coordination with the city redevelopment agency.

Selective wall texture or feature strips will be incorporated in the design for the exposed surface of the land side face of the concrete L-wall between Stations 29+70 and 32+33.

Public access to the dike for recreation does not seem justified since no unique features are present.

Provision for the handicapped are not required in connection with the architectural design. Exterior work in area of public access or use will reflect required criteria.

REAL ESTATE REQUIREMENTS

Estimated costs are summarized as follows:

Lands and Improvements	$	566,625
Temporary Construction Easements	$	31,500
Severance Damages	$	40,000
Relocation Assistance Costs	$	4,200
Acquisition Costs	$	35,000
Contingency Cost 20%	$	135,465
TOTAL	$	812,790
Use	$	820,000
October 1975 Price Levels		850,000

COST ESTIMATES AND COST APPORTIONMENT

General. Estimates of cost include all features for completion of the project and are based on computed quantities and unit prices current as of May 1975. A comparison of estimates is given in Table No. 1.

TABLE 1

COMPARISON OF ESTIMATES

Project Feature	Original Project: Project Document 1961 Price Levels	Original Project: GDM Jan 66	Original Project: Last Estimate to Congress, FY-72 Budget, 1970 Price Levels	Revised Project GDM May 75 Price Levels	Revised Project Current Estimate Oct 75 Price Levels
01. Lands & Damages	$ 180,000	$ 535,000	$ 655,000	$ 820,000	$ 850,000
02. Relocations	30,000	60,000	45,000	0	0
11. Levee & Floodwalls	2,167,000	4,006,000	8,380,000	2,480,000	2,595,000
13. Pumping Plant	544,000	499,000	750,000	1,235,000	1,290,000
19. Bldg. Grds. & Util.		15,000	20,000		
15.1 Pressure Conduit				1,790,000	1,870,000
Engineering and Design	271,000	345,000	920,000	1,150,000	545,000
Supervision & Administration	238,000	395,000	830,000	525,000	470,000
TOTAL COST	$3,430,000	$5,840,000	$11,600,000	$8,000,000	$7,620,000
Total Federal Cost	2,401,000	4,088,000	8,120,000	5,600,000	5,340,000
Non-Federal	1,029,000	1,752,000	3,480,000	2,400,000	2,280,000

(1) The cost increase in construction features between the project document ($2,920,000) and last estimate to Congress ($9,850,000) was based on price escalation and detailed design refinements. The E&D and S&A cost increases were due to reanalysis of requirements and Federal pay increases.

(2) The current changes are due to change in the project scope and modification to the design, quantity estimates and a reanalysis of unit prices to reflect construction costs of comparable projects in the area.

a. The E&D and S&A estimates have been reduced in the current estimate to conform with a Bill presently before Congress which states in part "that non-Federal interests shall bear no part of the cost of any design for this project rejected or otherwise not accepted by such interests prior to the date of enactment of this Act".

b. Costs for lands and damages based on estimates supplied by local interests who are in process of acquiring lands.

TABLE 2

Apportionment of Costs

Non-Federal Costs

Lands & Damages		$ 850,000
Cash Contribution (30% of Project Costs less Lands & Damages)		1,430,000
Non-Federal Cost	Total	2,280,000
Federal Funding		5,340,000
	Total Project Cost	$7,620,000

Annual Costs

The estimated annual costs are as follows:

1. Federal Investment		
a. Federal Fist Cost		$ 5,340,000
b. Interest During Construction (1a x 0.06125 x 1/2T) (T = 2 yrs.)		327,000
C. TOTAL FEDERAL INVESTMENT		$ 5,667,000
2. Federal Annual Charges		
a. Interest (1c x 0.06125)		$ 347,100
b. Amortization (1c x 0.000161)		900
c. TOTAL FEDERAL ANNUAL CHARGES		$ 348,000
3. Non-Federal Investment		
a. Contributed Funds		$ 1,430,000
b. Lands, Easements		850,000
c. TOTAL NON-FEDERAL FIRST COST		$ 2,280,000
4. Interest During Construction		
a. Interest (3c x 0.06125)		$ 140,000
b. TOTAL NON-FEDERAL INVESTMENT		$ 2,420,000

5. Non-Federal Annual Charges

a.	Interest ($2,420,000 x .06125)	$ 148,225
b.	Amortization (.000161)	400
c.	Maintenance and Operation	9,400
d.	TOTAL NON-FEDERAL ANNUAL CHARGES	$ 158,000

6. TOTAL ANNUAL CHARGES - 2c + 5d $ 506,000

SCHEDULE FOR DESIGN AND CONSTRUCTION

Design. Subsequent to the approval of the GDM, a feature design memorandum will be prepared and submitted for approval, being; the "Embankment, Foundations, Structures Memorandum." It is expected to be submitted in December 1976. Upon approval of the Memorandum contract drawings will be prepared and are expected to be completed in late calendar year 1977. A construction contract could be awarded in calendar year 1977.

Construction.

a. Pressure Conduit. Since construction of the Urban Renewal Project is being stymied until the pressure conduit is installed, the city of New London is eager to install the new conduit as soon as possible. The Urban Renewal Authority has engaged the services of an AE to design the pressure conduit for them in accordance with Corps criteria. Upon approval of this GDM, it is the intent of the city to complete the contract plans, advertise, award and construct the pressure conduit in its entirety as soon as possible. The cost of constructing the pressure conduit by the city is intended to be credited toward the financial obligation of the city in the cost sharing for the entire project. A letter report requesting approval of this procedure will be forwarded to OCE upon receipt of this GDM approval. Construction of the pressure conduit could be started in the spring of calendar year 1977.

b. Barrier. It is estimated that it will require two years to build the protective barrier. The phases of construction are briefly outlined below:

(1) First Construction Season. The Contractor is expected to concentrate on the pumping station, circular steel cells with "L" walls, and the "L" walls at the Access Road during the first construction season. At the pumping station the Contractor is expected to complete by winter the excavation, installation of his ground water control system, placing of concrete and complete the superstructure shell. During the winter time he will proceed to install the necessary equipment in the pumping station. Simultaneously, in the vicinity of the City Coal Company, the Contractor is expected to initiate work on the system of steel cells and "L" wall. He is expected to remove the unsuitable material in late spring, take approximately 3 months to erect and fill the steel cells and spend the remaining months of the first construction season forming and placing the concrete "L" wall on top of the cells. The "L" wall in the vicinity of the Access Road (Sta 29+70 to 32+33) is sufficiently removed such that work could be initiated at any time during the first season. Undoubtedly the Contractor would more than likely elect to complete the "L" walls in this reach as soon as possible so that he can reuse his forms for constructing the "L" walls on top of the cells.

(2) Second Construction Season. The major effort during the second season will be spent on constructing the various segments of dikes thereby completing the protective system. The rate of construction is expected to proceed rapidly since the dikes are relatively small and that he can initiate construction of the dikes in several locations simultaneously. As construction of the dikes progresses, the Contractor is expected to follow up with final grading, landscaping and cleanup.

OPERATION AND MAINTENANCE

General. Revised plans of the original design have reduced the work loss but costs have increased since 1966. O&M of the proposed project would be $9,400.

Estimated Cost. Estimate a crew of 1 Supervisor or (Superintendent) and one Laborer. Operation of the pumping station, inspection and maintenance, 1 week per month, with exception of full time during periods of hurricane alert or abnormal high tides. Assume 38 hours extra time for such periods.

a. Salaries.

1 WB-08 (1 week x 12 months x 8 hours + 38 hours = 134 hours)
134 hours x $5.05 = $676.70 Say $680.00
1 WB-05 (1 week x 12 months x 8 hours + 38 hours = 134 hours)
134 hours x $4.61 = $617.74 Say $620.00

b. Maintenance.

(1)	Concrete repairs Graffiti removal Joint repairs Vandalism	$ 1,000.00
(2)	Stone replacement 200 c.y. @$20.00= Vandalism Washouts	$ 4,000.00
(3)	Herbicide treatment	$ 1,100.00
(4)	Shaw Cove Pumping Station Minor repairs Equipment or plant replacement Painting Lubrication Snow removal	$ 2,000.00
		$ 9,400.00

IMPACT ASSESSMENT AND EVALUATION

For reference to the Impact Assessment and Evaluation of each alternative plan covering the economic, social and environmental discussion, see Part II of this report.

STATEMENT OF FINDINGS

Statement of Finding. I have reviewed and evaluated, in light of the overall public interest, the documents concerning the proposed action, as well as the stated views of other interested agencies and the concerned public, relative to the proposed New London Hurricane Protection Project, New London, Connecticut.

The possible consequences of these alternatives have been studied according to environmental, social well being and economic effects, including regional and national development and engineering feasibility.

In evaluation, the following points were considered pertinent:

a. Environmental Considerations. From the environmental standpoint the project plan will afford more enhancement than adverse effects. The recommended project will have beneficial effects on flood control and urban development. The impact of the project is a part of the urban development area, and adequately covered in the Environmental Impact Statement. Beneficial effects will be to make more land available for development, and to minimize the danger of flooding. The project offers no benefits to Fish & Wildlife resources, nor will it have any adverse effects upon these resources. No adverse environmental effects are known or anticipated if the project is built.

b. Social Well-Being Considerations. The over-riding social well-being consideration in the New London area is the reduction of the flood hazard that has caused tremendous damage and human suffering as well as restricting normal and higher utilization of land within the city. Construction of the tidal flood control improvements will make possible higher utilization of the area planned urban renewal redevelopment project, which will improve the physical and social environment of not only the project site, but the city of New London. This condition is mainly due to the city's small land area and because it is almost entirely built up.

c. Engineering Considerations. From an engineering standpoint, the recommended project would provide the degree of flood protection endorsed by the city. A pressure conduit was necessary to alleviate interior flooding. The protection was designed for a 100-year storm frequency which is a minimum requirement for urban renewal areas. Facilities required for this project will be based upon application of aesthetic criteria.

d. Economic Considerations. From an economic standpoint, I have selected the economically optimum plan by providing tidal flooding protection and economic growth. The recommended project will have a net effect of increasing employment, tax revenue and stimulate growth in the protected area.

I find that the proposed action, as developed in the Project Design is based on a thorough analysis and evaluation of various practicable alternative courses of action for achieving the stated objectives; that wherever adverse effects are found to be involved they cannot be avoided by following reasonable alternative courses of action which would achieve the congressionally specified purposes; that where the proposed action has an adverse effect, this effect is

either ameliorated or substantially outweighed by other considerations of national policy; that the recommended action is consonant with national policy, statutes, and administrative directives; and that on balance, the total public interest should best be served by the implementation of the recommendation.

Date 16 July 1975

JOHN H. MASON
Colonel, Corps of Engineers
Division Engineer

ENVIRONMENTAL IMPACT STATEMENT

General. A final Impact Statement was filed with the Council of Environmental Quality on 26 July 1971. Since that time extensive revisions in the original project design necessitated the preparation of a new Environmental Impact Statement. The new draft EIS was circulated for public review and comments on 30 July 1975. The final EIS addressed all comments and is presently being reviewed by O.C.E.

DRAFT EIS Fed. Register 15 Aug 75 (rec'd CEQ 4 Aug)

Final sent to OCE 3 May 76

RECOMMENDATIONS

Recommendations. The division Engineer recommends that the New London Hurricane Protection Project for the City of New London, Connecticut, be modified to reflect the desires of the local interests as outlined in this supplemental report to the authorized project.

It is further recommended, that during the preparation of the final design documents, the project configuration may be modified to provide protection to the New London Shaw Cove Urban Renewal Area consistent with the requirements of the Federal Housing and Urban Development Agency, and the City Redevelopment Agency. Also, that the assurances to be furnished by the non-Federal interests be modified for the hurricane protection at New London, Connecticut, such that responsible non-Federal interests are required to give assurances satisfactory to the Secretary of the Army, that they will:

a. Provide without cost to the United States all lands, easements, and rights-of-way necessary for construction of the project.

b. Hold and save the United States free from damage due to construction, operation, and maintenance of the project not including damages due to the fault or negligence of the United States or its contractors.

c. Accomplish without cost to the United States all modifications or relocations of existing sewerage and drainage facilities, buildings, utilities, and highways made necessary to construction of the project not to include sewerage and drainage facilities at the line of protection.

d. Maintain and operate all features of the project after completion in accordance with regulations prescribed by the Secretary of the Army.

e. Bear 30 per centum of the total first cost, presently estimated at $2,280,000, consisting of the items listed in paragraphs a. and c. and a cash contribution now estimated at $1,430,000. The cash contribution cost is to be paid in annual installments during the period of construction. Final settlement will be based on final allocation of actual first costs.

f. Require that habitable first floor elevations of all future construction be established at or above El. 10.5 M.S.L. within the urban renewal project area.

g. At least annually, notify local citizens that the project does not provide complete flood protection (i.e. beyond the 100-year event).

It is recommended the project plan providing tidal flooding protection to the city of New London be approved as the basis for completion of feature Design Memoranda and the preparation of contract plans and specifications.

Date: 16 June 1976

JOHN H. MASON
Colonel, Corps of Engineers
Division Engineer

APPENDIX A

REGRADING THE URBAN RENEWAL AREA

to the

100-YEAR STORM ELEVATION

ALTERNATIVE TO THE PROPOSED PLAN

Of all the alternative proposals studied, to provide hurricane flood protection for the urban renewal area, the most feasible appears to be regrading a portion of the renewal area to the 100-year storm elevation along with some of the features of the recommended proposed plan. The advantage of this alternative, in addition to its favorable cost comparison, is that regrading to an elevation to meet the HUD requirements avoids the creation of a false sense of security that is developed by a system of dikes and walls that could be over-topped in the event that the project design storm of 100-year frequency is exceeded.

This regrading proposal has constraints imposed on an area that is not acquired by the local urban renewal agency (an oil storage facility on the north shore of Shaw Cove) and by areas on the west end of the project area that are beyond the limits of the renewal project. These two locations require retention of some features of the proposed hurricane project to provide complete closure up to the 100-year storm level of protection.

The area proposed to be regraded to El. 10.5 msl is bounded by Bank Street on the north, Shaw Street on the west and Hamilton Street on the south. The till material, which is readily available within a reasonable distance of the project site, would be gradually sloped to meet the north and west shores of Shaw Cove. Sparyard Street defines the eastern limit of the regraded area. Existing grades and layout of Bank Street will remain to avoid costly disruption and interference with existing facilities and structures. All regraded areas and slopes will receive topsoil and seeding treatment for environmental considerations.

As under the proposed project, Sparyard Street would be a regraded ramp to provide access from existing Bank Street to properties on the unprotected waterfront areas. A 426 foot long concrete "L" wall, running parallel to the main line of the Penn Central Railroad, would provide closure between the regraded Sparyard Street and high ground at Bank Street. Regrading to El. 10.5 msl in this area is not feasible due to constraints imposed by existing facilities.

The oil storage facility, bounded by Bank Street on the north and Shaw Cove on the south, is another area which cannot be regraded since the oil company will not be displaced by the urban redevelopment project. A 300 foot long flood wall with top El. 10.5 will be required to provide closure in this area. The flood wall would consist of 10 - 20-foot diameter circular steel sheet cells with a reinforced concrete "L" wall. This was considered the most feasible scheme to avoid damages to existing oil tanks, and avoid interference with existing bulkheads and foundations.

A pumping station would be located on the west side of the oil storage facility on the north shore of Shaw Cove. At present, this station is sized (210 cfs) as under the proposed plan to provide pumping capacity for low areas that cannot be regraded and to provide for the future development of the renewal agency. Refinement and development of the renewal plan could reduce the pumping station requirements. For the purposes of this study it was decided to use the conservatively larger station for the present.

A 96" diameter pressure conduit as outlined for the proposed plan, will be required to intercept flows from Truman Brook and discharge into Shaw Cove adjacent to the proposed pumping station. This pressure conduit will convey a 100-year runoff from a higher level 540 acre drainage area with a coincident 10-year tide level of 6.5 msl. This condition governed the selection of the conduit diameter. Currently, Truman Brook is conveyed through the project area by an old, unpressurized box conduit.

ESTIMATE OF COST
Oct. 1975
Price Levels

Lands & Damages		$ 300,000
Levees & Floodwalls		3,160,000
Pumping Plant		1,290,000
Pressure Conduit		1,870,000
Construction Cost		$ 6,620,000
Engineering & Design		585,000
Supervision & Administration		540,000
Total Cost		$ 7,745,000
Federal Cost	(70%)	5,425,000
Non-Federal Cost	(30%)	2,320,000

Real estate costs would be limited to acquisition for the pumping station and flood wall land requirements east of Sparyard Street. The regrading and installation of the pressure conduit would require only construction rights of entry from the city. The regraded areas would remain city property for future urban renewal development. Assurances of local cooperation under this scheme would require first floor levels of future construction to be at a minimum of El. 10.5 msl.

This regrading scheme meets the minimum requirements of the Federal Housing and Urban Development Agency for new urban renewal areas to have a minimum flood protection for a 100-year storm frequency. The conservative cost estimate indicates a favorable comparison between the proposed plan of dikes and walls. Further refinements of this land fill scheme would be anticipated during the closely coordinated development of the city of New London redevelopment plans for the area and the final design phase of the Federal project.

PART II

IMPACT ASSESSMENT & EVALUATION

NEW LONDON

HURRICANE PROTECTION

IMPACT ASSESSMENT

AND EVALUATION

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I Introduction

The purpose of the New London Hurricane Project is to provide 100-year storm flood protection to Shaw Cove, New London, Connecticut. This report addresses planning criteria established by the Water Resource Council's Principles and Standards.

Principles and Standards are guidelines for the formulation and evaluation of alternative plans in water and related land resources. The following sections establish the need for flood protection and show how various alternative plans were developed to address these needs. The System of Accounts Display (Table II) provides impact evaluation of the proposed plan. The final section of the report presents a discussion of the proposed plan. The proposed plan was found to be the most economically, environmentally and socially acceptable alternative as it was the most conducive to planning objectives, Federal objectives and public desires.

II. Problem Identification

A. Identification of Needs

On June 15, 1955 the Corps of Engineers was authorized, by Public Law 84-71, to conduct a survey of hurricane damages along the eastern and southern seaboard of the United States. One outcome of this survey was the finding that a serious problem of hurricane flooding existed in New London Harbor, Connecticut, particularly in the Shaw Cove and Bentley Creek areas of the city. Severe damages, incurred due to hurricane flooding of New London Harbor, led to the authorization of the New London Hurricane Protection Project by the Flood Control Act of 1962. This act read, in part, as follows: "The project for hurricane flood protection at New London, Connecticut is hereby authorized substantially in accordance with the recommendations of the Chief of Engineers in House Document Numbered 478, Eighty-seventh Congress, at an estimated cost of $2,401,000".

The project design began in 1965 with initial construction funds authorized for FY 67. The City of New London was undertaking the development of a master highway plan and urban renewal plan from 1966 to 1968. The City therefore requested delays until their planning work could be completed.

The final design consisted of protection barriers for the Shaw Cove and Bentley's Creek area with appropriate navigation gates, street and railroad gates and a pumping station. These barriers

would provide protection from a Standard Project Flood. The New London City Council gave assurance of local support in February, 1970 and the required local funds were made available in November 1970.

Then, at a public meeting held on 10 February 1971, strong opposition to the expenditure of local funds for the 30 percent local share of the cost of the project was displayed. City officials requested that futher action on the project be delayed until they could perform a study to determine an alternate method of flood protection. Subsequnetly the City officials hired a consultant to study flood control alternatives to the hurricane barrier and appointed a Citizen's Task Force to review proposed alternatives.

After this review at the local level, the City Council requested the elimination of the Bentley's Creek protection and the relocation of the Shaw Cove dike so that the project followed the shoreline behind Shaw Cove. The city also requested that the degree of flood protection be reduced to a 100 year storm frequency. This degree of flood protection is required by HUD for funding of urban renewal projects.

After consultation with the City of New London, the Corps developed alternatives to comply with the city's request. These alternatives are presented in this document, along with the rationale for selecting "the Proposed Plan". It is important to note that the Proposed Plan was the only alternative acceptable to the city.

B. The Study Area

The following sections describe baseline conditions in Southeastern Connecticut, New London and, in particular, Shaw' Cove.

1. Geography

The Southeastern Connecticut Region consists of 18 towns in the southeast corner of Connecticut. This area of the state is predominantly rolling countryside drained by the Thames River and its tributaries. Five of the towns in the region are classified as rural, 10 are classified as suburban, and 3 are classified as urban.

The City of New London, which is located on the west bank of the Thames River, at the entrance to Long Island Sound, is the most densely populated of the three urban communities in the region. Almost all the land within the city's boundaries has been developed. The city has a total water frontage of 5.5 miles consisting of New London Harbor, several beaches, Green's Harbor, Shaw Cove and Winthrop Cove.

The Shaw Cove area, the site of the proposed project, was formerly a poorly-maintained mixed residential and low yield commercial and industrial area south of New London's Central Business District (CBD). Its shoreline consisted of railroad tracks, commercial boat service operations, a marina, distribution and transportation facilities and junkyard. Much of this area has been recently razed in preparation for redevelopment.

2. Demography

The Southeastern Connecticut Region accounts for 7 percent of the state's population. The Region's 1970 population was 220,000 up 23 percent from its 1960 population. This population growth occurred mostly in suburban towns.

Between 1910 and 1970, New London increased its population from 19,659 to 31,630. This represents a change of 61.2 percent. Until the mid 1960's, New London was the second largest community in the sourtheastern Connecticut Region. Since this time its population has declined and today, it is surpassed by Norwich.

In 1920, New London's population comprised 26 percent of the total population in the Southeastern Connecticut Region. In 1960 New London's share of the Region's total population had declined to 19.5 percent. Projecting 40 years into the future with some adjustment, New London would constitute 11.5 percent of the Region's total population by the year 2000 or 38,000 persons.

Some of the reasons for this projected decline include, 1) the lack of developable land for residential use; 2) the non-marketability of obsolete housing units; 3) migration of large families to the suburbs; 4) an increasing demand for non-residential land use. Thus the population decline is not due to adverse economic conditions, but to the lack of available land for new residential construction.

The Shaw Cove area is currently unpopulated as 95 percent of its residents have been relocated to make way for the urban renewal project. Formerly the Shaw Cove area was the ghetto section of New London. One third of its residents were black or Spanish-speaking people; another one-third were elderly, retired poor white people.

3. Climatology

The climate of the New London area is temperate and changeable; extremes of hot or cold weather are rarely of long duration. The average annual temperature of the area is 49 degrees F, and the average annual rainfall is 47 inches. Heavy rainfall and abnormally high tides occur with unpredictable frequency. Hurricanes can be expected in the late summer and early fall. The storm of record in the New London area occurred in 1938. This was a 60 year event with a tidal surge of 9.7 feet above mean sea level. Since 1938, New London has been subjected to tidal flooding from three major hurricanes and one severe storm. Historical hurricane data has been used to predict the 100 year tide level at 10.5 feet above mean sea level.

4. Resources

The region's major river, the Thames, extends 16 miles from Long Island Sound to the confluence of the Shetucket and Yantic Rivers at Norwich. Despite high pollution levels, the river contains significant wildlife and fisheries resources. Shellfish beds exist

in the river's estuary, although the entire estuary is closed to shellfish harvesting due to pollution. Currently theThames River is rated by the Connecticut Water Resources Commission as "SC", suitable for fish, shellfish and wildlife habitat, suitable for recreational, boating and industrial cooling, good aesthetic value".

The Commission has adopted an "SB" classification as a goal for the River. "SB" is defined as "suitable for bathing and other recreational purposes, industrial cooling and shellfish harvesting for human consumption after depuration, excellent fish and wildlife habitat; good aesthetic value".

5. Economics

In 1970 there were 73,000 civilian jobs available in the southeastern Connecticut Region. In addition to these jobs there were 15,000 employees stationed at the Navy Base and the Coast Guard Academy in Groton. Manufacturing jobs were 28,600 or 38 percent of the employment. Manufacturing has declined in relative importance in the last several decades.

Today the regions economy is highly dependent on defense. The Southeastern Connecticut Regional Planning Agency has estimated that 39 percent of the total regional population is dependent on defense and that income derived from defense employment in 1973 was over 40% of the region's total income. The multiplier effect of retail purchases of defense employees increases further the importance of the defense sector of the economy of the region.

New London's economic base has also changed over the years. The textile industry, which dominated the economy in the early 1900's has been replaced by the defense industry and retail services.

In 1970, manufacturing employment in New London accounted for 27 percent of the labor force. This was less than the 38 percent reported for the New London-Norwich labor market area. In the city, the percentage of non-manufacturing employment in the retail and personal and related services is 68 percent. This is considered high in comparison with the national norm of 45 - 55 percent. The present ratio for the city indicates that New London is serving a much larger population than is contained in the city proper. Furthermore, this is an indication of the city's past and continuing role as a regional retail and service center. During 1974 and 1975 non-manufacturing growth is expected to continue as new commercial developments will be required to meet the needs of an expanding factory work force in the labor market area. Although retail services have played an increasingly important role in New London's economy, there has been a shift in recent years in retailing patterns from New London to outlying communities due to the lack of developable land in the city and the blighted conditions of existing commercial buildings, such as those that existed in the Shaw Cove Area.

Today, New London has a higher than state average proportion of employed residents. However, New London families have lower than average incomes. In 1970, the median family income for New London was $9,657, about 82 percent of the state's median income. Altogether the city has a larger percentage of families below the "poverty level"* (10.2% compared to 5.3% for the state), and a smaller percentage of upper income families (20.9% compared to 31.1% for the state). These differences are partly a reflection of the types of jobs available in New London, many of which are in the relatively low-paying service industries.

In 1970 the income of residents of the Shaw Cove area was $6,120 significantly lower than the median family income of the rest of New London, and less than half of the state median. Only 3% of the area's families were in the $14,400+ category. The area was economically self-contained with most residents working in the immediate area or self-employed.

*Poverty statistics are taken from the U. S. Dept. of Commerce, General Social & Economic Characteristics, Conn. 1970. As defined by the Bureau of the Census, "poverty level" is an index adjusted by such factors as family size, number and age of children and sex of family head.

6. Land Use

Since 1951, the lack of developable land in New London has been clearly evident with only 8 percent of the city's land under developed. Because of this scarcity of developable land, the anticipated future demand should consist of both medium and high density residential usage, with a corresponding demand for commercial property. If new development is to occur, it must be through the intensification of existing uses or through the ability of New London to clear its deteriorating areas, like Shaw Cove, in order to accommodate new and more productive developments.

With the rapid growth rates which have characterized the neighboring communities of Groton and Waterford, New London's market potential for high density residential and commercial development may be in serious jeopardy. Should New London be unable to provide new developable sites, the present centralized regional development pattern could become diffused, and the city's historic position as the service and commercial center of the southeastern Connecticut Region would be jeopardized.

C. Future Conditions

1. Without Project

Without flood control measures, the study area would be subject to continued periodic flooding. The New London Redevelopment Authority would be forced to abandon its urban renewal project as it would not receive HUD funding. The Shaw Cove area has already been

evacuated, and 95% of the buildings have been razed in anticipation of the urban renewal project. Without urban renewal, the Shaw' Cove area would be subject to New London's flood plain zoning restrictions which prohibit the construction of residential units in the area, and discourage the commercial and industrial development by requiring that all buildings be flood proofed to provide protection at a 100 year storm level. Flood proofing, which generally consists of isolating individual buildings with walls, bricking up cellars or raising buildings, is not an attractive solution to flood protection as it has limited protection capacity and is usually quite costly. Without the urban renewal project, which depends upon the implementation 100-year flood protection measures being developed by the Corps, the land in the Shaw Cove section will remain underutilized.

In recent years, New London's population has declined due to its limited housing supply. In addition, the city's ability to retain and expand its historic position as the service and commercial center of southeastern Connecticut is becoming questionable. New development is needed to arrest the city's population decline and maintain its economic status. If new development is to occur, it must be through intensification of existing land uses or through the ability of New London to clear its deteriorating areas like Shaw Cove, in order to accommodate new and more productive developments. Underutilization of land in the Shaw Cove area would not comply with New London's growing development needs, and therefore lead to an eventual decline in economic activity.

No attempt has been made to estimate future flood damages based on the assumption that the urban renewal project would not be implemented and that land in the Shaw Cove area would remain underutilized. A damage and benefit analysis was performed considering the urban renewal project in place. Properties to be protected by the Corps flood control project include the development planned by the New London Redevelopment Authority and the existing property in the protected area that that will not be replaced during renewal (a total of 45 acres) and 18 acres of properties adjoining the project area. Stage-damage and damage frequency curves were developed for the proposed urban renewal site development. These curves were based on depth-damage information for developments similar to that proposed for the Cove. The redevelopment agency furnished information relative to the type and value of property expected to be constructed. Estimates of average annual benefits were then derived from future damage-frequency curves.

A survey of actual flood losses in the area were made by damage analysts in 1968. Based on June 1976 price levels, the reported estimated total damages from the 1954 flood amounted to $3.0 million. (See Table 1). These losses include damages to the 18 acres of land which are on the perimeter of the urban renewal site. With a repeat of the 1954 flood, losses in the perimeter area are estimated to be $652,000. Total damage at +3 stage level could be as high as $7.3M.

TABLE 1

TOTAL DAMAGES - 1954 FLOOD

1. Urban Renewal Site		
Property not to be acquired	$	227,000
Property to be acquired	$	2,200,000
2. Perimeter Area		652,000
TOTAL DAMAGES	$	3,079,000

The damages for the Redevelopment Area are projected to be substantially more than those previously caused by the 1954 flood. Historical experience has indicated that damages, for a given degree of physical flooding, tend to increase over the time. This development factor is the product of two trends; (1) items of greater value are produced and found in the flood plain as technology becomes more advanced; and (2) increased development occurs in the flood plain in response to growing population pressures. With the intensive outgrowth of commercial activity, Shaw Cove urban renewal area will be no exception to those trends.

Without the Corps solution, average annual future damages to the new property are estimated to be $687,000 inside the renewal area. Damages to properties in the Urban Renewal Area that will not be replaced during renewal and to those outside the project are judged to be $158,000. Thus, total annual losses would be $845,000.

2. With Project - The Most Probable Future

With the implementation of flood protection measures developed by the Corps the "most probable future" for the Shaw Cove area will be redevelopment. The New London Redevelopment Authority has already initiated an Urban Renewal Project which will encompass approximately four blocks in the Shaw Cove area. When completed, the urban renewal project will make 45 acres of land available for development. The city has already established agreements with outside interests for the development of the area. A modern and enlarged marina with accompanying boating and personal services facilities is planned for the shoreline, and, inland, retail stores, commercial service establishments and residential units are planned. New water, sewer and utility lines will be constructed to replace older, poorly maintained lines.

Under with-the-project conditions, future annual flood control benefits are estimated $642,000. Benefits to the property to be constructed, discounted to the base year at 6-1/8 percent, were projected to be $514,000. An amount of $128,000 would be received by the peripheral outside area and existing property in the protected area that will not be acquired by urban renewal. Residual annual losses, resulted from events greater than 100-year flood, amount to $191,000.

External economies will be realized as the Shaw Cove renewal project is expected to extend benefits to other areas. One area is located on the periphery of the Central Business District (CBD). One half of this district is part of the Winthrop Urban Renewal Project which is now under construction. The remaining portion of the CBD lies between both urban renewal areas and is expected to be favorably effected by the spinoff from the surrounding developments. Likewise, the CBD should

receive benefits from the tourist trade attracted to the marina facilities and the proposed industrial-commercial office complex. Redevelopment benefits, according to Senate Document No. 97 of the 87the Congress, were estimated based on the value of labor and other resources required for project construction only. In this case, no benefits were considered for labor engaged in project operation and maintenance as the need is expected to be small and the work will most likely be handled by the regular public work force of the community. Annual redevelopment benefits were estimated at $61,670. Thus total annual benefits (flood control and redevelopment) of the project would be $704,000.

D. Planning Objectives

The objective of this project is to provide 100 year flood protection at least to 45 acres of land in the Shaw Cove area of New London, Connecticut. Satisfaction of this objective will allow the people of New London to realize their expectations for the area i.e. the Shaw Cove Urban Renewal Project.

III Formulation of Alternatives

In 1974, during initial planning stages for flood protection for the Shaw Cove area, urban renewal activity had not yet begun. At this time, five alternative plans were developed:

A. No Action

The "No Action" alternative would result in continued periodic flooding of the area. New London's urban renewal program

would not receive HUD funding, and future development of commercial and industrial land in the Shaw Cove area would remain restricted by New London's flood plain zoning restrictions and provisions of the Federal Flood Insurance Program. Knowledge of this possibility would keep businesses from expanding into the area and affect the area's land values.

B. Flood Proofing

This alternative, which generally consists of isolating individual buildings with walls, bricking up cellars or raising buildings has limited protection capacity. Many of the buildings in the area have deteriorated to a point where their destruction is necessary under the urban renewal program. Thus protection of these buildings at a 100-year storm level does not appear economical or practical

C. Permanent Evacuation

This alternative consists of the removal of all inhabitants and buildings from the 63 acre area that would be protected by the proposed project. This action would not address study objectives as it would force the abandonment of the urban renewal project area and 18 acres of properties adjoining the urban renewal area adjacent to the Central Business District. Further abandonment of taxable properties would aggravate the population decline and economic problems of New London.

D. The Original Protection Plan

The original protection plan provided flood protection for both the Shaw Cove and Bentley Creek segments of the city. The Shaw Cove segment consisted of a rock-faced earth dike, approximately 1,900 feet long running across Shaw Cove in the Thames River. Within the dike a 45 foot navigation gated opening was provided to permit the passage of boats.

E. Flood Protection Improvements and Site Grading

This alternative plan for flood protection consists of various structural and non-structural measures.

At the northern end of Shaw Cove, a berm starting at elevation +14 msl and ending at elevation +12.0 msl would be used. The area north of the berm would be graded down to the general elevation of existing Bank Street. This berm would be interrupted by a floodwall along the southern property of the City Coal Company. The City Coal Company property would not be acquired by the urban renewal project, and portions of the property are currently at an elevation of +5.0 msl.

At the western side of the Cove, a berm would begin at elevation +7.5 msl at the bulkhead line. The area west of the berm would be filled such that grades would gradually increase, reaching an elevation of +12.0 msl, approximately 150 feet west of the bulkhead line. Grading at the northwest corner of the Cove would ensure that an unbroken contour at elevation +12.0 msl would be maintained along the north and west edges of the Cove.

At the southwest corner of the cove the berm would continue west across Howard Street to Hamilton Street, tying back to high ground at the Hamilton Street and Shaw Street intersection.

A special problem exists with the Billings F. Learned Mission property on the east side of Shaw Street, which is currently at elevation +5.0 msl. This property would not be acquired by the project, and adjacent parcels of land would be at elevations ranging from +8.0 msl to +10.5 msl. It is recommended that the change in grade from the Mission property to adjacent land be accomplished in as short a distance as possible, and that a small stormwater ejector station be utilized to lift stormwater from the Mission property to a drain discharging to Bank Street.

This alternative also includes a pumping station and pressure conduit for relief of runoff when the water level exceeds the normal gravity outlet.

F. The Proposed Plan and Alternative Alignments

The proposed project will provide flood protection to approximately 63 acres peripheral to the Central Business District of the City. The properties that will be protected include (1) the development planned by the New London Redevelopment Authority, (2) the existing property in the renewal area that will not be replaced during renewal, and (3) 18 acres of properties adjoining the project area. The project extends from high ground at Hamilton Street on the south end and terminates at high ground at Bank Street on the north end.

In general, this alignment follows the shoreline rather closely but is modified as necessary to be compatible with the Shaw Cove Urban Renewal Plan, to avoid costly real estate, and to provide access to real estate outside the project. The top elevation of the project from the south end to the City Coal Company at the north end will be at elevation 12.0 feet above mean sea level and from the City Coal Company to the north end will be at elevation 14.5 feet. The added elevation at the north end will provide protection against wave action for the portion that is directly exposed to the Thames River.

The major features of the project are an earth berm, "L" walls, pumping station and pressure conduit (See Plate 1). The latter two features are essential to the relief of runoff when the water level exceeds the normal gravity outlet. The total protection is approximately 3,400 feet long.

Six alternatives to the proposed berm and flood wall alignment were examined. The selected alignment was the end product of economics, local acceptability and environmental considerations. Little flexibility existed in the alignment selection due to constructions of the shoreline, the main line railroad tracks, the existing structures and the urban renewal development plans.

There were two areas of the project which permitted variation in the project alignment. In the vicinity of the City Coal Company, an extensive investigation was made as to the structure and alignment most suitable to provide the necessary protection. Two of the six alignments excluded the tank farm from the area being protected whereas four alignments provided protection for the oil tanks. The plan selected was considered to be the most desirable since it was found to be the least disruptive, a sound engineering solution, least potentially damaging to the oil tanks, least risky and more aesthetically pleasing. The selected plan was acceptable to the City.

A second area with alternative solutions was on the Sparyard Street access to the railroad tracks and businesses outside the protection barrier. A street gate was considered. Current plans call for a ramp to replace the gate. This solution is less costly and easier to operate.

As planning progressed four of the above alternatives were eliminated. The alternatives of No Action and Evacuation received no further consideration as they did not meet the study objectives of providing the 100 year

flood protection required for the implementation of the urban renewal project. Floodproofing was found to be uneconomical and unfeasible for many of the buildings in the 63 acre area. The original protection plan was rejected by the city due to its high cost. Only two alternatives were found to be reasonably acceptable and in accordance with study objectives. They were:

1. Construction of an earth berm and floodwall along the shoreline of Shaw Cove (the Proposed Plan).

2. Flood protection improvements and site grading.

In the final planning stages of the project, the New London Redevelopment Authority commenced its urban renewal activities. Residents of the urban renewal area were relocated, and most of the buildings were razed. Agreements were signed with outside interests for redevelopment of the 45 acre area. Taking into account the amount of urban renewal activity that has already taken place, it appears that the Shaw Cove Urban Renewal project must be considered a reality. If the assumption is made that the urban renewal project must be realized, the alternatives (1) to construct an earth berm and floodwall, and (2) to grade the site are the only reasonable alternatives. The proposed plan to construct a berm and floodwall was the only plan acceptable to the public.

The following section will present an impact analysis and evaluation, as required by the Water Resource Council's Principles and Standards, of the two final alternatives. Principles and Standards, which

are guidelines for planning water and related land resources, require that a plan optimizing National Economic Development (NED) and at least one plan optimizing Environmental Quality (EQ) be developed. In this planning effort, the proposed plan to construct a berm and floodwall is both the NED and EQ plan. The plan to fill the Shaw Cove area to the 100-year flood level was found to be both economically, environmentally and socially undesirable.

IV. Impact Analysis and Evaluation (The System of Accounts)

The Water Resource Council's Principles and Standards require that all alternative plans carried through the final planning stage must be evaluated against both planning objectives and federal objectives of National Economic Development (NED), Environmental Quality (EQ), Social Well-Being (SWB) and Regional Development (RD). The mechanism for displaying each alternative's significant beneficial and adverse contributions to both these objectives is called the System of Accounts (SA). This display mechanism allows trade-offs between alternative plans to be compared. More specifically, the System of Accounts must (a) describe each alternative carried through the final planning stage, (b) display the planning objectives, (c) present each plan's performance against planning objectives and federal objectives, and (d) indicate timing, geographical incidence, uncertainty, exclusivity and actuality associated with the evaluation of significant impacts.

Table II provides the System of Accounts information required by Principles and Standards. A detailed explanation of these tables is supplied in the following Sections.

A. Alternatives Displayed.

Flood protection alternatives considered in the final planning stages and displayed in the System of Accounts are:

1. Construction of an earth berm and floodwall and alternative alignments.

2. Flood Protection Improvements and Site Grading. *

Since there is very little difference in alignments in the berm and floodwall alternative due to the constructions of the shoreline, existing structures, and urban renewal project, only one alignment (the proposed alignment) will be evaluated in the System of Accounts display. The other alignments were found to be slightly less acceptable to the public, more costly and more disruptive.

B. Planning Objectives

The planning objective is to provide 100-year hurricane flood protection for approximately 45 acres of land in the Shaw Cove area of New London, Connecticut. Both alternatives displayed in the System of Accounts satisfy this objective.

C. Federal Objectives

Principles and Standards requires that alternative plans carried to final planning stages be evaluated against the four national

* Systems of Accounts Display for Site Grading is available if required.

accounts or objectives of National Economic Development, Environmental Quality, Social Well-Being and Regional Development. The System of Accounts in Table II evaluates each alternative according to its beneficial and adverse contributions to these objectives.

In addition, Section 122 of theRivers and Harbors and Flood Control Act of 1970 requires that at a minimum, the following impacts or effects be addressed in the evaluation of alternative plans for water resource management.

Social Effects

Noise

Displacement of people

Esthetic values

Community cohesion

Community growth

Economic Effects

Tax Revenue

Property values

Public Facilities

Public Services

Employment/labor force

Industrial Activity

Displacement of farms

Desirable Growth

Environmental Effects

Man-made resources

Natural resources

Air

Water

These effects are addressed within the System of Accounts framework and are noted with an asterick (*).

D. Other Evaluation Criteria.

Principles and Standards requires that certain specified evaluation criteria be applied to alternative plans to test their responsiveness. These criteria are listed below with their code numbers used in the SA display.

1. Timing

Code	
"I"	Impact expected to occur prior to or during plan implementation.
"II"	Impact estimated to occur in 5 years or less after implementation of a plan.
"III"	Impact estimated to occur later than 5 years after implementation of a plan.
"+"	Impact occurs at indicated period and continues for an indefinite future period.

2. Uncertainty

Code	
"4"	The uncertainty associated with an impact is greater than 50%.
"5"	The uncertainty is between 10% and 50%.
"6"	The uncertainty is between 0% and 10%.

3. Exclusivity

Code	
"7"	Overlapping entry; fully monetized in NED account.
"8"	Overlapping entry; not fully monetized in NED account.

4. Actuality

Code	
"9"	Impact will occur with implementation.
"10"	Impact will occur only when specific additional actions are carried out during implementation.
"11"	Impact will not occur because necessary additional actions are lacking.

Also, Principles and Standards requires that impacts or effects be evaluated according to geographical regions in which a significant portion of any beneficial or adverse impact will occur. As a minimum, at least one region and the rest of the nation must be shown. In this study, effects on Shaw Cove, New London, the SMSA, the State of Connecticut and the rest of the nation were evaluated. The effects

on two areas, Shaw Cove and the rest of the nation, are displayed as they were found to be the only regions receiving consistently significant impacts.

The System of Accounts display, at the end of Part II of this report, is set up to address the proposed alternative's impact on the four national accounts. Impacts under each account are listed on the left hand side of the table. Timing of the impact is noted by the code of I, II, III; the region of impact is indicated by "Yes" or "No". Other impact evaluation criteria (uncertain exclusivity and actuality) are noted in parentheses under the region of impact.

The plan to build an earth berm and floodwall is both the NED and EQ plan and is therefore the proposed plan. These tables are followed by a brief description of impacts of the proposed plan.

V. Discussion

The following sections discuss environmental, social and economic impacts of the Proposed Plan:

A. Social and Economic Impacts

Social impacts of the project may be divided into direct impacts of the dike structure, and indirect impacts resulting from the urban renewal project, which depends on the construction of the dike for a required degree of flood protection.

Beneficial impacts of the structure itself are the protection of private property and public utilities from 100-year storm flooding and the creation of a more aesthetically pleasing shoreline with a potential

for waterside walkways or bicycle paths along the top of the dike. However, construction of these walkways and paths would not be a Corps responsibility.

Indirect beneficial impacts resulting from the implementation of the Redevelopment Authority's urban renewal project are numerous. One of the most blighted areas of the city will be totally razed. Thus the area will be more aesthetically pleasing and conform to the city's planning objectives to improve the economic and social infrastructure of New London.

Recreational opportunities will increase. The city has plans for the expansion of an existing marina from 350 to 600 slips. This marina is currently quite heavily utilized by residents of New London County. Its location provides more protection in heavy storms than other marinas in the area.

Inland, retail stores, commercial service establishments, a new apartment complex to replace the deteriorating Shaw St. apartments and a convalescent home, employing 180 people, are planned. New water and sewer lines, utilities, and new or improved streets will be part of the new development. With more modern public services, maintenance should be greatly reduced and there should be less potential for the creation of health hazards.

An upgrading of the residential area beyond Shaw and Hamilton Streets will be attempted through the Urban Renewal Program's Concentrated Code Enforcement Program and a Rehabilitation Program. The Enforcement program will combine strict enforcement of neighborhood building codes with 3% interest loans to owners of residences or businesses to aid them with compliance. This area was originally

scheduled for inclusion in the renewal project but withdrawn due to funding constraints. The Rehabilitation Program will provide loans for complete rebuilding. This program, as of March 1976, had a $5 million dollar public investment.

Modifying the physical arrangements of an area to improve it for human purposes necessarily alters the environment. Often the resulting changes are considered adverse and care must be taken to minimize them. However, in a dilapidated area such as Shaw's Cove, changes in the environment may be desirable. The joint efforts of the New London Redevelopment Authority and the Corps will provide flood control, improve land utilization and introduce environmental quality features. Together these changes will create a more satisfactory urban environment for the types of businesses and residences that the city of New London favors.

Adverse social impacts of the dike structure are the temporary increase of noise and dust levels during construction, and the creation of a permanent visual barrier from the water side of the project.

However, because of the slope of the surrounding ground, people walking along the streets outside the renewal project will be able to see over the dike to the cove or the new buildings. Dust and noise levels should be minimized by sound engineering practices.

Adverse impacts of the urban renewal project are related to the displacemen

of people. Displacement may result in the break-up of neighborhoods and the creation of new pockets of poverty elsewhere in the city.

Former residents of Shaw's Cove may not be able to move back to the area as the urban renewal project will replace low-cost housing with a smaller number of units for middle income families. There is no indication that former residents of the area were involved in the formulation of urban renewal plans; however, each apartment renter was given $4,500 for relocation compensation. Responsibility for insuring an adequate supply of low cost housing rests with the city government and related state and federal agencies. In addition, low-income residents outside the urban renewal area may be forced out of an area convenient to the downtown business district, as the renewal project may cause marked increases in land values. Again the responsibility for preventing this outcome does not rest with the Corps, but with the city and its redevelopment agency.

In summary, adverse impacts of the renewal project are in the sphere of social equity. However, it is not within the Corps authority to mitigate these impacts.

Economic impacts may also be divided into direct and indirect impacts. The major beneficial economic impacts of the dike structure will be the realization of annual benefits (flood control and redevelopment) amounting to $704,000. Upon completion of the project in Shaw Cove, economic development is expected in this new flood-free area. Flood protection will make it possible to clear and develop the land in the renewal area in accordance with city development plans. Without flood protection, the renewal area is likely to remain vacant after it is cleared.

In addition, the Corps project will increase employment opportunities for the many skilled and semi-skilled laborers during the construction phase of the product. Construction jobs in this lagging industry will be available for 3 years. The unemployment rate in the state of Connecticut is 12.1% (Jan 1976). Approximately 50% of the total state labor force of 178,500 is within easy commuting distance of New London.

Beneficial economic impacts of the urban renewal project will be the stimulation of commercial, industrial and recreational development in the Shaw Cove area. This development will increase employment and tax revenue. Property values in and around the Shaw Cove area will increase. Existing firms in the Central Business District, which is contiguous to the urban renewal area should also benefit from urban renewal, largely due to the tourist trade that will be attracted to the new marina facilities.

The Crocker marina which will expand from 350 to 600 slips is expected to provide the favorable environment for both the commercial and residential development in the project area. With excellent railroad service to New York City and new ferry service planned to Long Island, the recreation and tourist industry adds a new dimension to the future prosperity of New London. The shoreline of the Penn-Central railroad provides two hour service to New York City; and the estimated travel time by ferry to Long Island should be only one hour. Vacationers from both areas are expected to use the facilities at Shaw Cove; a modern and enlarged marina with its complimentary commercial businesses

would encourage not only more tourism but also more frequent patronage by the local residents.

Another beneficial impact of the urban renewal project will be the relocation of Howard Street. A wider relocated Howard St. will improve access and road transport to the downtown area for residents below Hamilton St. Also the presence of stores and services on the new Howard St. will offer shopping facilities and possible long-term sources of employment to the residents of the area. The preceding economic developments greatly aid New London in maintaining its position as the service and retail center of southeastern Connecticut.

Adverse economic impacts of the urban renewal project are minor, compared to the benefits.

In summary, the major beneficial impact of the Corps proposed plan is flood control, which is the essential element in the City's redevelopment program. The economic resources that the renewal area generated will provide favorable impacts. However, there are minor adverse short-term impacts such as construction noise, traffic and aesthetic impacts which can be mitigated by engineering techniques. The major adverse impacts of the total renewal program are that it displaces a poor, elderly and disproportionately black and Spanish speaking population and reduces the city's supply of low-income housing. These adverse impacts again can be mitigated somewhat by the work of the city's relocation agency and by the availability of special program funds to insure that relocated households have standard quality housing.

B. Environmental Impacts

The major beneficial environmental effect of the proposed plan is the protection of 63 acres of land from floods up to a 100-year storm frequency.

Adverse environmental effects of the proposed plan are minor and, for the most part, short term. There will be temporary degradation of air and water quality during the construction phase of the project. Approximately 2,600 feet of shoreline and 1/4 acre of cove bottom will be committed for the dike structure; and various man-made and natural resources will be utilized or expended in the construction of the dike. During the operational phase of the project, pumps run by a diesel engine will be activated during periods of high water. Adverse impacts resulting from pumping will be periodic energy consumption and possible fuel spills in handling the diesel fuel.

TABLE II

EFFECTS OF PROPOSED PLAN

	TIMING	PLANNING AREA SHAW COVE	REMAINDER OF NATION
1. NATIONAL ECONOMIC DEVELOPMENT (NED)			
Flood Damage			
*Present Conditions:			
Average Annual Flood Damages	I	$ 158,000	NO
Average Annual Residual Damages	I	30,000	NO
Average Annual Inundation (Flood Damage) Reduction	I	$ 128,000 (6,9)	0
**Future Conditions (with urban renewal):			
Average Annual Flood Damages	II	$ 845,000	NO
Average Annual Residual Damages	II	203,000	NO
Average Annual Inundation (Flood Damage) Reduction	II+	$ 642,000 (6,9)	0
Benefits			
Existing Average Annual Flood Reduction	I	$ 128,000	0
Area Redevelopment	I	62,000	0
Total Current Average Annual Benefits	I+	$ 190,000 (6,9)	0
Future Average Annual Flood Reduction	II	$ 642,000	0
Area Redevelopment	II	62,000	0
Total Future Average Annual Benefits	II+	$ 704,000	0
Average Annual Cost	I	$ 506,000	0
Benefit Cost Ratio		1.4	N.A.

*Includes only peripheral area. Urban renewal site in 1975 had no property. All buildings were razed.

**Includes urban renewal and peripheral.

EFFECTS OF PROPOSED PLAN

	TIMING	PLANNING AREA SHAW COVE	REMAINDER OF NATION
2. ENVIRONMENTAL QUALITY (EQ)			
a. Beneficial Effects			
Archaeological and Historical Resources			
Increase flood protection of Shaw Mansion	II	Yes (6,9)	NO
*Natural Resources			
Protects 63 acres of land from floods up to a 100 year storm frequency	II	Yes (6,9)	NO
b. Adverse Effects			
*Water Quality			
Increases turbidity of water	I	Yes (6,9)	NO
Creates potential for spillage of fuel used to run construction equipment and pumps.	I+	Yes (5,9)	NO
*Air Quality			
Lowers air quality due to increased traffic and use of construction equipment	I	Yes (6,9)	NO

EFFECTS OF PROPOSED PLAN

	TIMING	PLANNING AREA - SHAW COVE	REMAINDER OF NATION
2. ENVIRONMENTAL QUALITY (EQ) (cont.)			
b. Adverse Effects (cont.)			
*Man-made Resources			
Commits man-made resources such as concrete, steel, etc. for plan implementation	I+	Yes (6,9)	Yes (6,9)
*Natural Resources			
Commits natural resources such as earth fill for plan implementation	I+	Yes (6,9)	Yes (6,9)
Commits 2,600 ft. of shoreline on Shaws Cove to dike structure	I+	Yes (6,9)	No
Commits 1/4 acre of bottom of cove and 3 1/2 acres of land for structural and pumping facilities	I+	Yes (6,9)	No
Fish and Wildlife			
Has negligible adverse effect on fish and wildlife	I	Yes (6,9)	No

EFFECTS OF PROPOSED PLAN

	TIMING	PLANNING AREA SHAW COVE	REMAINDER OF NATION
3. REGIONAL DEVELOPMENT (RD)			
Income			
Increases in the area in long run as unemployed or underemployed labor factor inputs rejoin the labor force	II+	Yes (6,10)	NO (#)
Increases in the area from expenditures by imported construction workers	I	Yes (6,9)	NO
Employment*			
Increases employment in area during plan implementation	I	Yes (6,9)	NO
Increases employment in area in the long run	III	Yes (6,10)	NO
Expands the labor force in the area	II	Yes (6,10)	NO
Population			
Encourages long run growth in the region	III	Yes (6,10)	NO

EFFECTS OF PROPOSED PLAN

	TIMING	PLANNING AREA SHAW COVE	REMAINDER OF NATION
3. REGIONAL DEVELOPMENT (RD) (cont)			
Desirable Community Growth*			
Intensification of existing land use	II+	Yes (6,10)	No
Contribute to existing development by reducing depressing economic effects of flood damages	II	Yes (6,10)	No
Reduce flood insurance premiums	II+	Yes (6,9)	No
Removes restriction on federally related financing for existing flood-prone properties	II	Yes (6,9)	No
Compatible with city wide objectives for future land use	I	Yes (6,10)	No
Increases industrial activity*	II	Yes (6,10)	No
Taxes and Government Spending*			
Increases Business activity and tax revenues*	II+	Yes (6,10)	No
Improves property values*	II	Yes (6,10)	No
Encourages municipal expenditures to improve * community facilities (new water and sewer lines, new utilities, improved or new streets)	I	Yes (6,10)	No

EFFECTS OF PROPOSED PLAN

	TIMING	PLANNING AREA SHAW COVE	REMAINDER OF NATION
3. REGIONAL DEVELOPMENT (RD) (cont.)			
Recreation			
Modern and expanded marina with accompaning boating and personal service facilities.	II+	Yes (6,10)	No
Transportation			
Improve access to central business district	I	Yes (6,10)	No
Farm Displacement	-	NO	NO
4. SOCIAL WELL-BEING (SWB)			
a. Beneficial Effects			
Disposable Real Income			
Allows people with increased per capita income to move into area.	I+	Yes (6,10)	NO
Life, Health and Safety			
Enhances community health through provision of better housing and new improved public utilities and services	II	**Yes** (5,10)	NO
Reduces flood damages	I+	Yes (6,9)	NO

EFFECTS OF PROPOSED PLAN

	TIMING	PLANNING AREA SHAW COVE	REMAINDER OF NATION
4. SOCIAL WELL-BEING (SWB) (cont.)			
Public Services			
Provides flood protection of new public services	II	Yes (6,9)	NO
Cultural and Recreational Opportunities			
Creates potential for waterside walkway or bicycle path on top of dike	II	Yes (4,9)	NO
Permits development of expanded marina and park area along the cove	II	Yes (5,9)	NO
*Desirable Community Growth			
Agrees with long range land use plans of the city	III	Yes (6,9)	NO
Is the only plan acceptable to the city	I	Yes (6,10)	NO
*Aesthetics			
Eliminates one of the most blighted areas of the city	I+	Yes (6,9)	NO
Creates more aesthetically pleasing shoreline than currently exists	I+	Yes (6,10)	NO

EFFECTS OF PROPOSED PLAN

	TIMING	PLANNING AREA SHAW COVE	REMAINDER OF NATION
4. SOCIAL WELL-BEING (SWB) (cont.)			
b. Adverse Effects			
*Displacement of people			
Requires relocation of residents	I	Yes (6,10)	NO
Requires relocation of small businesses	I	Yes (6,10)	NO
*Destroys community cohesion	I+	Yes (6,10)	NO
*Noise and Dust			
Increases noise and dust levels during construction	I	Yes (6,9)	NO
*Aesthetics			
Creates a solid visual barrier from outside the project	I+	Yes (6,9)	NO

PART III

COORDINATION WITH FEDERAL, STATE & LOCAL AGENCIES

LETTERS OF COMMENT & CONCURRENCE

NEW LONDON HURRICANE BARRIER

Letter Dated	Contents	Exhibit
Feb 28, 1975	Governor of Connecticut	1
Feb 18, 1975	Executive Director New London Redevelopment Agency	2
May 19, 1975	City of New London	3
11 Mar 75	U.S. Dept. of Interior National Park Service	4
	Historic Preservation	5
26 Mar 75	U.S. Dept. of Interior Fish & Wildlife Service	6
24 Feb 75	New England Regional Commission	7
6 Mar 75	U.S. Dept. of Interior Bureau of Outdoor Recreation	8
4 Mar 75	U.S. Dept. of Commerce National Oceanic and Atmospheric Administration	9
Feb 24, 1975	State of Connecticut Dept. of Transportation	10
Feb 25, 1975	U.S. Dept. of Transportation Federal Highway Administration	11
Feb 20, 1975	State of Connecticut State Department of Health	12
Mar 13, 1975	New England River Basin Commission	13
Feb 21, 1975	Dept. of Transportation	14
Mar 3, 1975	U.S. Coast Guard	15
Oct 16, 1975	Dept. of Housing and Urban Development, Hartford, Conn.	16
Apr 20, 1976	City of New London	17

COORDINATION WITH FEDERAL, STATE AND LOCAL AGENCIES

The following Federal, State and local agencies were asked to furnish their view and letters received incorporating pertinent comments, are attached.

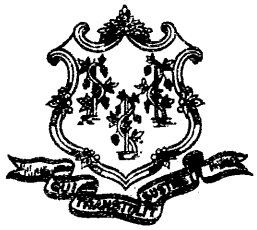
U.S. Environmental Protection Agency
U.S. Department of Commerce
U.S. Department of Commerce Coastal Zone Management NOAA
U.S. Department of Housing and Urban Development
U.S. Department of Interior Bureau of Outdoor Recreation
U.S. Department of Interior Fish and Wildlife Service
U.S. Public Health Service Environmental Health Service
U.S. National Park Service New England Region
U.S. Coast Guard, 1st Coast Guard District
U.S. Department of Transportation
U.S. Federal Highway Administration
U.S. Department of Agriculture
New England Regional Commission
New England River Basin Commission
State of Connecticut Department of Environmental Protection
State of Connecticut Commissioner of Health
State of Connecticut Department of Agriculture
State of Connecticut Commissioner of Transportation

Summary of Views. Comments received from the above agencies are favorable to the project plan and were given consideration in the preparation of this report. The U.S. Fish and Wildlife resources foresee no adverse effects on fish and wildlife as a result of the revised project.

State of Connecticut Department of Transportation states that the project will not adversely affect the existing facilities or any projects planned in the New London area.

The city of New London endorsed the revised project and found it compatible with the urban redevelopment area. The proposed revision has been discussed with city representatives and fully coordinated with the Executive Director of the New London Redevelopment Agency.

ELLA GRASSO
GOVERNOR



STATE OF CONNECTICUT
EXECUTIVE CHAMBERS
HARTFORD

February 28, 1975

Mr. John M. Mason, Colonel
Corps of Engineers
Division Engineer
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Mason:

Thank you for your letter concerning the proposed New London Hurricane Barrier.

I appreciate your courtesy and your efforts to keep us informed.

With best wishes,

Cordially,

Ella Grasso

ELLA GRASSO
Governor

EXHIBIT 1

NEW LONDON CONNECTICUT REDEVELOPMENT AGENCY

31 UNION STREET • NEW LONDON, CONNECTICUT 06320 • PHONE: 442-4337

February 18, 1975

John Wm. Leslie
Chief, Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Re: NEDED-E
New London Hurricane Barrier Project
Shaw's Cove Urban Renewal
Project CONN. R-126

Dear Mr. Leslie:

We have reviewed Inclosure No. 2, submitted February 10, 1975, with our consultants, Cahn Engineers, and find it in essential conformance with our previous understandings.

When final design commences, however, we would like to be involved as there are some minor concerns that we would like to resolve.

Sincerely,

Robert P. Turk
Executive Director

cc: C. Francis Driscoll, City Manager
John A. Hofmann, Cahn Engineers

EXHIBIT 2

CITY OF NEW LONDON
CONNECTICUT

May 19, 1975

Mr. John Leslie, Chief Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

RE: NEW LONDON HURRICANE BARRIER PROJECT
NEDED-E

Dear Mr. Leslie,

The City's position concerning the New London Hurricane Barrier Project remains as stated in my February 23, 1972 letter to you. The revised project is to protect the Shaw's Cove Urban Renewal Project against hurricane tidal flooding. The project revision consists of deleting the Bentley Creek protection barrier from the authorized project and modifying the Shaw's Cove barrier to a land based protection scheme. The degree of flood protection is to be at the 100 year storm frequency level.

The Shaw's Cove Urban Renewal Project is now in execution, completing 55% of its land acquisition activities and anticipating the commencement of site improvement activities during the coming summer months. The City anticipates that the Corp will continue to work with the Redevelopment Agency to insure the compatibility of the flood protection project with the renewal project and that the flood protection project will be conducted as expeditiously as possible.

Sincerely yours,

C. Francis Driscoll
City Manager

ir

EXHIBIT 3

United States Department of the Interior

NATIONAL PARK SERVICE
WASHINGTON, D.C. 20240

IN REPLY REFER TO:

H34-PR

MAR 1 1 1975

Mr. John Wm. Leslie
Chief, Engineering Division
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02151

Dear Mr. Leslie:

Thank you for your letter of February 10, 1975, to Dr. Connally, requesting information concerning sites that might be affected by the New London Hurricane Barrier Project, New London, Connecticut.

Enclosed is a list of sites and their locations in New London that are presently included in the National Register of Historic Places. As this is not a complete listing of the historical and archeological resources in the proposed project area, you should contact the State Historic Preservation Officer concerning additional sites that might be included in the State inventory. You should also keep in mind that a professional quality survey should be completed to identify all the resources in the area and determinations of eligibility for listing in the National Register should be sought for those that might qualify pursuant to Executive Order 11593 and Section 800.4(a)(2) of the procedures of the Advisory Council on Historic Preservation (36 CFR 800).

Enclosed is a copy of instructions for obtaining such determinations. If we can be of assistance with these or any other matters, please do not hesitate to contact us.

We appreciate your cooperation on behalf of historic preservation.

Sincerely yours,

A. R. Mortensen
Director, Office of Archeology
and Historic Preservation

Enclosures

CONSERVE AMERICA'S ENERGY

EXHIBIT 4

Save Energy and You Serve America!

United States Department of the Interior

NATIONAL PARK SERVICE

NORTH ATLANTIC REGION
150 CAUSEWAY STREET
BOSTON, MA. 02114

IN REPLY REFER TO:

L-7619-NAR-(CE)
(Hurricane Barrier
New London, CT)

March 17, 1975

Mr. John Wm. Leslie, Chief
Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

This is in response to your letter of 10 February requesting our review and comment on your New London Hurricane Barrier Project, New London, Connecticut.

While the review material (two drawings) enclosed with your letter does not provide sufficient detailed information for us to understand the depth of your environmental evaluations, we can see the geographic location and scope of the project. We would understand that you are preparing a supplement to an environmental impact statement (filed July 26, 1971), and we would fully expect to see our concerns addressed in that supplement. You should understand that our comments herein are presented solely as technical information from the National Park Service to assist you in preparation of the environmental statement supplement and in no way represents an official review position of the Department of the Interior. We would expect a consolidated Departmental review to be accomplished when your environmental statement supplement is filed with the Council on Environmental Quality and circulated for comment.

The proposed project will not adversely affect any existing, proposed or known potential unit of the National Park System, or any known historic, natural, or environmental education sites eligible for the National Landmark Programs.

As required by the Historic Preservation Act of 1966, E.O. 11593 and being of a bonafide part of the human environment scope of the National Environmental Policy Act of 1969 (1970), careful consideration must be given to cultural resources which break into three basic elements; historical, architectural and archeological. Although the National Park Service has extensive expertise in these areas, we do not have complete knowledge

EXHIBIT 5

of the significance of all sites or ones being considered for nomination to the National Register of Historic Places, nor does the Service maintain a complete inventory of all areas of archeological potential.

Therefore, to assure the Corps of no inadvertent oversights, we suggest that you contact the State Historic Preservation Officer (Mr. John W. Shannahan, Director, Connecticut Historical Commission, 59 South Prospect Street, Hartford, Connecticut 06106) for additional clearance on these cultural resources and to contact, Dr. Douglas F. Jordan, University of Connecticut, State Archeological Museum, Storres, Connecticut 06268, for qualified professional advice on the potential of archeological values in the project area and appropriate protective steps to be taken should any such values exist.

As indicated above, we would anticipate official Departmental review of your environmental statement supplement and would expect to find therein an adequate discussion of your considerations for cultural resources, an evaluation of your project upon the resources and what measures of mitigation would be taken for protection of such resources.

We appreciate this opportunity to input to the interagency coordination phase of your planning/decision process.

Sincerely yours,

David A. Richie
Acting Regional Director

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
Post Office and Courthouse Building
BOSTON MASSACHUSETTS 02109

MAR 26 1975

Division Engineer
New England Division, Corps of Engineers,
424 Trapelo Road
Waltham, MA 02154

Dear Sir:

Mr. Leslie's letter of February 10, 1975, requested our comments on your revised plan for the New London Hurricane Barrier Project, New London, New London County, Connecticut. This special report supersedes our report of February 17, 1966, and is submitted in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). It has been coordinated with the Connecticut Department of Environmental Protection and the National Marine Fisheries Service.

Your original project involved separate barriers for the Bentleys Creek and Shaw Cove area, consisting of earth-filled dikes and concrete walls. The revised plan calls for the deletion of the Bentleys Creek protection and relocation of the Shaw Cove barrier. Project features call for earth dikes and I-walls around the northwest shores of Shaw Cove, with a street gate, pumping station and pressure conduit.

With the exception of approximately 300 feet of earth dike just inside the entrance to Shaw Cove, all dikes and I-walls will be constructed on the upland. Therefore, we foresee no adverse effects on fish and wildlife resources as a result of the revised project. Should the seaward slope of the 300 feet of dike partially constructed in the water be faced with stone riprap, a modest enhancement of fishery habitat will occur. There would also be a small amount of fishermen utilization of this section of dike, if access is permitted.

Sincerely yours,

ACTING Regional Director

EXHIBIT 6

NEW ENGLAND REGIONAL COMMISSION
53 STATE STREET
BOSTON, MASSACHUSETTS 02109

FEDERAL COCHAIRMAN

February 24, 1975

Mr. John W. M. Leslie, Chief
Engineering Division
Department of the Army
New England Division, Corp of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

Thank you for your letter of February 10, 1975 concerning the reformulating of the New London Hurricane Barrier Project for New London, Connecticut. We have reviewed your letter and the attached material and find that we have no problem with the proposed project. As a matter of fact, since the Commission is concerned with the economic well-being of the region, we find that the proposed project would not only provide employment during the construction phase, but would also protect the New London area. It is therefore consistant with the economic development goals of the New England Regional Commission.

Sincerely,

Russell F. Merriman
Federal Cochairman

WRK/drm

EXHIBIT 7

United States Department of the Interior

BUREAU OF OUTDOOR RECREATION
NORTHEAST REGIONAL OFFICE
Federal Building - Room 9310
600 ARCH STREET
Philadelphia, Pennsylvania 19106

IN REPLY REFER TO:

MAR 6 1975

Mr. John W. Leslie
Chief, Engineering Division
New England Division
U. S. Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

Dear Mr. Leslie:

We are pleased to response to your letter of February 10, 1975, asking for comments on the revised New London Hurricane Barrier Project.

A positive effort should be made to institute non-structural programs for the reduction of flood damage whenever possible. In that light, it would have been most helpful to know the consideration you have given to the non-structural alternatives for this project.

From the information you have made available, this project seems to present an excellent opportunity to relocate the urban renewal out of the flood prone area. This would save the cost of constructing the hurricane barrier and assure against future losses that very well may occur even if it is constructed. If this could be done, it would help reverse the trend of ever increasing flood losses coupled with larger and larger annual expenditures for flood protection.

Although this project proposal is primarily designed to give hurricane protection, if it is constructed, consideration should be given to providing walkways and benches along the earth dike portion of the project.

We thank you for the opportunity to comment on this reformulated project and look forward to further cooperation with your Office.

Sincerely,

JOHN A. HAUPTMAN
Assistant Regional Director
Resource Planning Services

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

EXHIBIT 8

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Rockville, Md. 20852

Ax2

March 4, 1975

Mr. John W. Leslie
Chief, Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Attention: NEDED-E

Dear Mr. Leslie:

We have your letter of February 10, 1975, advising of action by your office to reformulate the New London Hurricane Barrier Project, New London, Connecticut. Because of our desire to be as responsive as possible, it is necessary that our reply be jointly prepared by our National Ocean Survey, National Weather Service and Office of Coastal Zone Management. We are proceeding as expeditiously as possible and will forward our comments in the near future.

Sincerely,

Robert L. Sorey
Deputy Executive Officer

EXHIBIT 9

STATE OF CONNECTICUT
DEPARTMENT OF TRANSPORTATION
24 Wolcott Hill Road, P.O. Drawer A
Wethersfield, Connecticut 06109

JOSEPH B. BURNS
COMMISSIONER

February 24, 1975

Mr. John Wm. Leslie
Chief, Engineering Division
Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

Subject: Hurricane Barrier Project
Shaw Cove, New London, Connecticut

As requested in your letter of February 10, 1975, the Department of Transportation has reviewed the preliminary plan of the Hurricane Barrier Project proposed for the Shaw Cove area in New London.

Our review has indicated that the Barrier Project will not adversely affect our existing facilities or any projects planned in the general New London area.

Very truly yours,

Joseph B. Burns
Commissioner

EXHIBIT 10

U. S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
REGION ONE
990 Wethersfield Avenue
Hartford, Connecticut 06114

February 25, 1975

IN REPLY REFER TO:
01-09.3

Mr. John Wm. Leslie
Chief, Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

Mr. R. E. Kirby, Regional Federal Highway Administrator, has asked that I reply for him on the proposed New London Hurricane Barrier.

We have reviewed your proposed location plan submitted on February 10 for its impact on the Federal-aid highway system.

One roadway is affected, Howard Street, which was added to the Primary Type II system at the request of the City. This made it eligible for TOPICS funding. Howard Street will apparently be cut in two by the proposal and may therefore have to be removed from the Federal-aid system. However, as the city, according to your letter, is in agreement with the plan we have no objection, and will take action to initiate the system change.

We are submitting your plan to the Connecticut DOT for their information and action. Should they have any comments they will submit them directly to you.

Sincerely,

D. J. Altobelli

D. J. Altobelli
Division Engineer

EXHIBIT 11

STATE OF CONNECTICUT

STATE DEPARTMENT OF HEALTH

79 ELM STREET HARTFORD, CONNECTICUT 06115

OFFICE OF PUBLIC HEALTH

February 20, 1975

566-4081

Attention: NEDED-E

Mr. John Wm. Leslie, Chief, Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

We have reviewed the report on the revised New London Hurricane Barrier Project, New London, Connecticut.

The Connecticut State Department of Health offers no comment to the proposal.

Very truly yours,

Harold S. Barrett, M.D.

Harold S. Barrett, M.D.
Deputy Commissioner

HSB/b

EXHIBIT 12

NERBC

NEW ENGLAND RIVER BASINS COMMISSION

55 COURT STREET • BOSTON, MASSACHUSETTS 02108
PHONE (617) 223-6244

March 13, 1975

Mr. John Wm. Leslie
Chief, Engineering Division
U. S. Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear John:

The Long Island Sound Study staff is so tied up in report review that there is no way to take the time to respond constructively on the New London Hurricane Barrier project.

I would assume that the State of Connecticut would use the Long Island Sound report as one basis for developing its own response.

Yours very truly,

Frank Gregg
Chairman

FG/n

EXHIBIT 13

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
COMMANDER (oan)
FIRST COAST GUARD DISTRICT
150 CAUSEWAY STREET
BOSTON, MASS. 02114
Tel: 617 223-3632

3260

21 FEB 1975

Mr. John Wm. Leslie
Chief, Engineering Division
Department of the Army
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

Dear Mr. Leslie:

I am in receipt of your letter NEDED-E dated 10 February 1975 regarding the proposed New London Hurricane Barrier Project. Please be advised that New London is geographically located in our Third Coast Guard District. Thus, I have forwarded your letter with all enclosures to Commander (oan), Third Coast Guard District, Governors Island, New York, New York 10004, for their comments.

Sincerely,

R. W. VAIL
Lieutenant (JG), U. S. Coast Guard
Operations Officer
Aids to Navigation Branch
By direction of the Commander
First Coast Guard District

Copy to:
Commander (oan), Third Coast Guard District

EXHIBIT 14

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS:
Commander (mep)
Third Coast Guard District
Governors Island
New York, New York 10004
(212) 264-4916

5922/19.bI
13/75
MAR 3 1975

Mr. John Wm. Leslie, Chief
Engineering Division
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

We are responding to your letter of 10 February, which seeks to coordinate the reformulation of plans for the New London Hurricane Barrier Project, being undertaken by your Agency.

A review of the reformulated plan ("INCL 2," attached to your letter), indicates that existing Coast Guard facilities in the area, under the command of Coast Guard Group Long Island Sound, will not be adversely affected.

The above review should not be intepreted as an evaluation of the project's effectiveness or of its possible environmental impacts.

Sincerely yours,

W. R. JURGENS
Lieutenant, U. S. Coast Guard
Acting Chief, Marine Environmental Protection Branch
By direction of the District Commander

cc:
Commander, Group Long Island Sound

EXHIBIT 15

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

AREA OFFICE
999 ASYLUM AVENUE, HARTFORD, CONNECTICUT 06105

AREA OFFICES:
Boston, Massachusetts
Hartford, Connecticut
Manchester, New Hampshire

REGION I
REGIONAL OFFICE
BOSTON, MASSACHUSETTS

October 16, 1975

IN REPLY REFER TO:

Mr. George Sarandis
Project Engineer
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Sarandis:

Subject: Urban Renewal Project Conn. R-126
(Shaw's Cove)
New London, Connecticut

This is to advise you that the flood protection to be provided by the U. S. Army Corps of Engineers for the Shaw's Cove Project, Conn. R-126 is a mandatory and integral part of the urban renewal plan and HUD's involvement in the project area.

Sincerely,

Daniel P. Kolesar
Director
Community Planning & Development Div.

EXHIBIT 16

CITY OF NEW LONDON
CONNECTICUT

April 20, 1976

Colonel John H. Mason
Division Engineer
U.S. Army Corps of Engineers
New England Division
424 Trapelo Road
Waltham, Massachusetts 02154

RE: NEW LONDON HURRICANE PROTECTION
New London, Connecticut

Dear Colonel Mason:

This letter is to assure you of our need for adequate funding and construction of the Land-Based Hurricane Protection Project proposed by the Corps for the Shaw's Cove area. Not only will lives and property be protected in a significant part of our community, but the integrity of our on going $20,000,000, HUD funded, Shaw's Cove Urban Renewal Project will be insured.

This urban renewal project has been in execution since 1973 with land acquisition 80% complete, clearance 50% complete, and site improvement contracts underway. Land is and will continue to be available for Corps construction and no delays are anticipated.

The City of New London has been and continues to be prepared to execute appropriate assurances and to provide the local share of costs for the flood protection project as required.

Sincerely,

C. Francis Driscoll
City Manager

D:s

EXHIBIT No 17

CORPS OF ENGINEERS — U. S. ARMY

INTAKE STRUCTURE
96" PRESSURE CONDUIT
72" STORM DRAIN (INTERIOR DRAINAGE)
"L" WALL TOP EL. 14.5
96" PRESSURE CONDUIT
SHAWS COVE PUMPING STATION
DIKE TOP EL. 14.5
DIKE TOP EL. 12.0
Truman Brook
GRAND STREET
JEFFERSON AVE
BANK STREET
Limit of Shaws Cove Urban Renewal Area
Sta. 34+96.5
PENN. CENTRAL R.R.
SPARYARD ST.
RAMP
Proposed Relocation of Howard Street (By others)
SHAW STREET
HOWARD STREET
Dumping Area (Fill Made)
HAMILTON STREET
SHAW'S COVE
HARBOR
LONDON
NEW

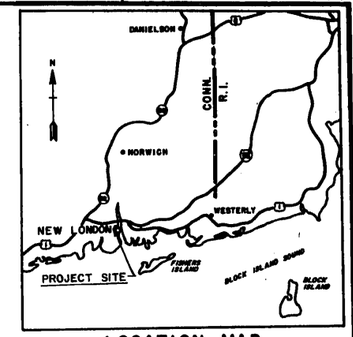
E.176000 E.176200 E.176400 E.176600 E.176800 E.177000 E.177200 E.177400 E.177600 E.177800 E.178000 E.178200 E.178400 E.178600 E.178800 E.179000

N189200 N189000 N188800 N188600 N188400 N188200 N188000 N187800 N187600

1 2 3 4 5 6 7 8

N

LOCATION MAP
SCALE: 1" = 7.0 Mi. approx.



PLAN
SCALE: 1" = 100'

GENERAL NOTES:
1. Elevations refer to Mean Sea Level Datum.
2. All elevations are plus except as noted otherwise.
3. Plane coordinates refer to Connecticut Lambert Grid System.

GRAPHIC SCALES
1" = 100': 100' 0 100' 200'
1" = 7.0 MI: 7.0 0 7.0 14.0

SAFETY PAYS

REVISION	DATE	DESCRIPTION	BY

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY | DR. BY | CK. BY

SUBMITTED
CHIEF, SECTION
APPROVAL RECOMMENDED
CHIEF, TECH. DIV. BRANCH
REVIEWED
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF BRANCH

WATER RESOURCES DEVELOPMENT PROJECT
NEW LONDON HURRICANE BARRIER
SHAW'S COVE
GENERAL PLAN
NEW LONDON CONNECTICUT

APPROVED DATE
CHIEF, ENGINEERING DIVISION

SCALE: AS SHOWN | SPEC. NO.
DRAWING NUMBER
SHEET

PLATE 2-1